



Promoting earth architecture as a sustainable construction technique in Egypt



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ABSTRACT

The resource scarcity, energy problems, and pollution resulting from the use of conventional building materials, in addition to the rising costs of construction and transportation fuels are all factors driving many countries to consider low impact, cheap building methods that are environmentally friendly and appropriate for use in the modern context. This directs attention back to earth, one of the oldest building materials throughout history, which has successfully illustrated many technical, economic, social and environmental benefits that could fulfil the need for an alternative building material. Yet many doubts still face the use of earth, when compared to other conventional building materials that dominate the market nowadays (like concrete and steel) especially in countries like Egypt. However, the urgent call for sustainability in the building sector, as well as the rising demands for affordable housing units in Egypt, present a good opportunity to revive back the use of traditional materials like earth with their simple, cheap and quick techniques that could successfully meet these demands and apply sustainability on the long run.

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1. Introduction

“The adaptations of earth building techniques to meet the demands of an industrial society are often quite ingenious. As the world’s developing nations become industrialized they abandon their strong earth building traditions”, (Rael, 1971).

Many environmental, ecological and economic issues have started directing the world’s attention towards an urgent need for adopting sustainability in all fields. According to the World Business Council for Sustainable Development (WBCSD), the building sector is responsible for around 40% of the world’s energy use, (The EEB report 2009). This in return has driven many countries to concentrate their efforts on finding effective ways to reduce the carbon footprint of the building sector along with investigating alternative sustainable building materials that have less negative impact on the surrounding environment. Where, ‘earth in the context of architecture is the most earth friendly material that exists’, (Rael, 1971).

Earth architecture has illustrated many environmental, social and economic advantages that are currently hidden by many untrue speculations. However, its ability to provide rich designs and technical ingenuity could easily enable it to fit into the

contemporary architectural context. This in return has encouraged many developed countries to introduce it back in their building environment and promote its use. Nevertheless, many doubts still face the use of earth when compared to conventional building materials that dominate the market nowadays (like concrete and steel) especially in countries like Egypt.

The rising demands for affordable housing units present a good opportunity to revive back the use of traditional local materials like earth with their simple, cheap, and quick techniques that could successfully meet these demands, especially in rural areas where technical skills and trained workers are often not available. Earth architecture is strongly related to the physical, social and economic context of Egypt. It can help accommodate changing demographics, including future income levels and in providing possible opportunities for the phased expansion of the unit over time to accommodate household growth. Earth architecture can help in applying sustainable development principles, limiting the consumption of non-renewable resources (plastics, oil etc.) and maintaining healthy dwelling, environment and land use. It also utilizes an efficient and locally acceptable method of construction and material which minimizes the construction time. Furthermore, it can help minimize life cycle costs of housing units by reducing construction, maintenance and operating costs, and in addition to that it maximizes the functional life of the dwelling unit. Consequently it can relate to economic efficiency in buildings (invested costs against overheads).

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The lack of a niche for sustainable building materials and the general lack of environmental awareness are the main barriers against promotion of earth architecture. There is a need to investigate the perception towards earth architecture in Egypt, and develop an overview of the construction market in order to identify opportunities that can help promote it, revive traditional techniques, and enhance the use of local building materials as a sustainable alternative on the long run.

2. Key research questions

The research will investigate the use of earth architecture as an appropriate construction technique in Egypt, while addressing the following:

- i. Investigating the main qualities of earth architecture as well as the main issues facing it and their explanations.
- ii. Illustrating the environmental benefits of earth as a building material in order to reflect its sustainability.
- iii. Identifying the social, economic and political opportunities and barriers against earth architecture.
- iv. Examining different case studies that reflect the perception of earth architecture in Egypt.
- v. Developing a strategy that can help to promote earth architecture in Egypt and address sustainability on the long run.

3. Historical background of earth architecture

'In ancient times unbaked earth was used in Mesopotamia and Egypt, while later on Romans and Muslims built with earth in Europe, Africa and the Middle East- as did the people of the Indus civilizations, Buddhist monks and Chinese emperors. During the middle ages, construction in unbaked earth was practised not only in Europe but in North America by the Indians, in Mexico, by the Toltecs and the Aztecs, and in the Andes by the Mochica. The Spanish conquerors of America took with them European techniques of earth architecture and grafted them onto traditions already established there. In Africa, this art was mastered in cultures as diverse as those of the Berbers, the Dogons, the Ashanti, the Bamilikés or the Haussas, in the kingdom of Ife and Dahomey and in the empires of Ghana and Mali', (Dethier, 1981).

The use of Earth in buildings has also been related to the different periods of crisis in which its use increased after the two world wars, and during the period of post war, when it was used by many of the European countries. In the 1970's the energy crisis has again turned attention towards the use of mud architecture as better sustainable alternatives that required low in construction, (Mohamed, 1995).

Nowadays earth architecture is usually only related to environmentally conscious clients and designers, (Rael, 1971). However recently under the urge for finding more sustainable building materials many developed countries have started realizing the efficiency of earth as a building material and investigated ways to promote its qualities and introduce them to new buildings as a better environmental alternative.

4. Modern applications of earth architecture

There are different examples for the use of earth in modern architecture. Below are a few examples among many of them;

The Chapel of Reconciliation (Rammed Earth), which was built on 2000 in Berlin, Germany by Reitermann and Sassenroth. This building has proved to be environmental friendly and energy efficient, using simple construction materials like; rammed earth walls and timber frames, and it also succeeded in becoming a land mark that is appreciated by the public, (Rael, 1971).



Fig. 1. The handmade school in Bangladesh. Source: Rael 1971.

The Eco House (Mud Brick), which was built on 1991–1992 in Norrköping, Sweden by the Norwegian architect Sverre Fehn. The building was constructed using simple traditional materials, which saved in the cost as well as in energy. This example illustrates that by simple treatments earth buildings could be used in cold weather as well as hot temperate weather, (Rael, 1971).

The Handmade School built in Bangladesh by the German – Austrian architecture team of Anna Heringer and Eike Roswag. In this project the architects have decided to use their design as a mean to improve the traditional cob culture and address its problems directly. Accordingly, they used the construction of the school as a vehicle for educating builders and laypeople in ways to construct long lasting beautiful structure. The Handmade school they designed received the Aga Khan award, as seen in Fig. 1, (Rael, 1971).

Other examples include; sports and art centre, Lancashire, constructed in the year 2000, and located in Skelmersdale, Lancashire. The Eden project visitor centre, constructed between 1999 and 2000, and located in St Austell, Cornwall. The Keppel gate, Devon, constructed in the year 2002, and located in Ottery St Mary's, Devon, (Morton, 2001).

5. Lessons learnt from the previous use of earth in buildings

'Vernacular traditions experimented with, consolidated and refined over centuries are among the most valuable and reliable sources of information on the techniques appropriate to the soils of an area and a guide to the structural and climatic benefits of the systems employed', (Norton, 1997).

The lessons learnt is summarized as following, (Little, 2001);

- The survival and the high endurance of earth buildings are not only due to the durability and the techniques used in its application, but also due to the quality of workers and the appropriateness of the design to a particular setting or a region.
- The regular maintenance and repair techniques used and their compatibility to the original construction are very important for its preservation.
- Traditional earth building techniques which are simple and labour intensive could be adapted to modern self-build form of construction. Development in mechanization could also relate those techniques for modern industrial applications.
- The preservation of the local knowledge and cultural patterns previously used in earth buildings is very important to assure its proper development.

6. Methods and techniques

There are many different developed methods in earth architecture; however the most common of them are as following;

6.1. Mud brick

This technique requires mixing sand, clay, water and some sort of organic material like; straw, dung or sticks. Then the mixture is shaped in blocks and left to dry naturally in the sun for

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